Ontario

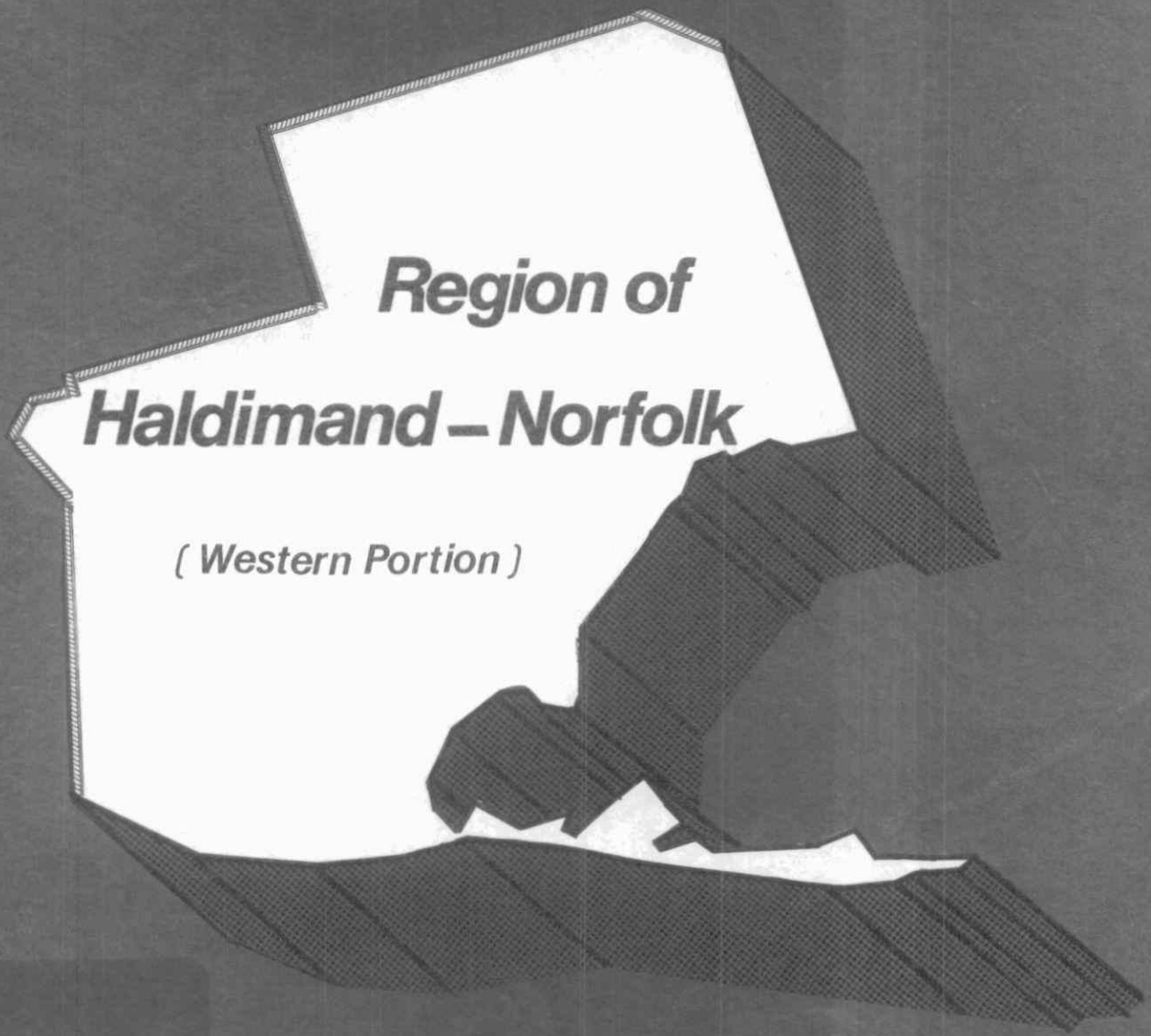
Ministry
of the
Environment

Water Resources
Map 3124

Water Resources Branch
Hydrology and Monitoring Section

Region of Haldimand – Norfolk

(Western Portion)



Ground Water Probability

by
A. Hickinbotham
1977

REGION OF HALDIMAND – NORFOLK (WESTERN PORTION)
1977

GROUND WATER PROBABILITY
REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK
(WESTERN PORTION)

Descriptive Notes

Introduction

The western portion of the Regional Municipality of Haldimand-Norfolk (formerly County of Norfolk) has a highly developed agricultural economy in which tobacco is the major cash crop. Substantial amounts of water are required to irrigate the tobacco crop and a large proportion of this water demand is satisfied by ground-water sources, especially on a vast sand plain that covers a large proportion of the study area. In this sand plain area, ground water for irrigation is commonly obtained from farm ponds which are dug into the water table and from multiple sand-point systems that are capable of meeting most tobacco irrigation demands.

Ground water is also an important source of supply to the municipalities of Simcoe, Waterford, Delhi and a number of smaller communities with communal water systems as well as being used extensively for private domestic purposes. Although ground water is used for much of the Regional Municipality's water supplies, it is not always economically available, of sufficient quantity or of suitable quality for all types of land development. To help contend with these potential problems, this publication provides essential information on which ground-water related decisions can be based.

In this publication, ground-water availability on a regional scale is indicated in terms of probable quantities of water available, depths at which water is commonly found and water quality at sampled locations. Because of the complexity of ground-water occurrence, the information is presented on four map sheets:

Sheet 1: Supplies in Shallow Overburden.
Sheet 2: Supplies in Deep Overburden.
Sheet 3: Supplies in Bedrock.
Sheet 4: Water Quality.

The information shown on Sheet 1 pertains only to materials within 50 feet of the ground surface, as shown on Map 1. The information shown on Sheet 2 pertains to overburden materials that extend from 50 feet below ground surface to bedrock.

Hydrogeologic interpretations have been based on data obtained from over 3000 water-well records on file with the Ontario Ministry of the Environment, 1800 oil and gas wells on file with the Ontario Ministry of Natural Resources and from past studies of ground-water availability. The appropriate references are listed on each map sheet. Reliability of the interpretations varies throughout the study area and a periodic updating or revision of the present interpretations may be necessary as new hydrogeologic information becomes available.

Evaluation of Prospective Well Sites

By using the maps in this publication along with the following step-by-step procedure, prospective well sites can be evaluated in terms of probable yields, the likely depths to water-bearing zones and the likely quality of water. Subsequently, this information can be used in other considerations such as: possible water treatment, pump type and size, well cost and type of well construction (a table illustrating the different types of well construction and their applications is appended).

As a first step, the amount of water required from the prospective well should be estimated. Assessing domestic and livestock requirements is discussed in the appendix. Then, the maps should be used in the suggested sequence in order to search for the most economical well supplies. Map 1 indicates yields from the shallowest formations and should be consulted first as progressively deeper and more costly wells will have to be constructed as water is sought from the deeper formations indicated on maps 2 and 5.

Evaluation Procedure

To evaluate yields:

1. locate the well site on Map 1 of Sheet 1;
2. note the colour of the map at the well site;
3. refer to the legend and relate the colour to the appropriate probable yield;
4. if the probable yield does not meet your requirements, repeat steps 1 through 3 using Map 2 on Sheet 2. Similarly, if probable yields determined from Map 2 are insufficient, repeat the same steps using Map 5 on Sheet 3.

To evaluate the depths to water-bearing zones:

5. if Map 1 was selected in the above steps, water-bearing zones occur at depths easily reached by shallow dug and bored wells and sand points; if Map 2 was selected, locate the well site on Map 3 and note the depths to the water-bearing zones by using the legend; if Map 5 was selected, locate the well site on Map 6 and note the depths to the water-bearing zones by using the legend;

6. exact depth to water-bearing zones for individual existing wells are shown on maps 1, 2 and 5.

To evaluate water quality:

7. to evaluate the likely ground-water quality at a potential well site, locate the site on the selected yield map and note the nearby ground-water sampling points. The chemical analyses of these samples are found in the Inorganic Chemical Analyses, tables 1, 2 and 3 on Sheet 4. To interpret the significance of the analyses, refer to the "Water Quality" section in these notes.

Overburden Thickness

Overburden thickness (Map 4) generally increases from east to west. In the east, overburden is often less than 50 feet thick and in some areas almost absent. In the southwest, overburden reaches a maximum thickness of over 300 feet.

Bedrock Geology and Topography

Bedrock geology (Map 7), as described by Sanford (1969), consists predominately of limestone and dolomite, with some shale located in the southwestern part of the Regional Municipality.

There is an over-all rise in the bedrock surface from the south to the north. Elevations increase from a low of under 275 feet west of Long Point to a maximum of over 750 feet northwest of Boston.

The Onondaga Escarpment is a major topographic feature in the north-eastern corner of the study area and trends southeast-northwest between Bealton and Boston. The bedrock surface drops from approximately 725 to 650 feet over this escarpment.

Ground-Water Yield

On each of the yield maps, the quantities of water available to single wells are presented as probable yields of less than 2 gpm (gallons per minute), 2 to 10 gpm, 10 to 50 gpm and greater than 50 gpm. Because of variations in the local hydrogeology, the type of well construction, and the reliability of available data, the probable well yields indicated on the maps may not represent everywhere the yields that are available to all wells. However, the indicated yields are thought to be good approximations in most areas. In cases where reliable, long-term yields are sought, it will be necessary to undertake detailed hydrogeologic investigations and pumping tests.

In shallow overburden (Map 1), low yields of less than 2 gpm are encountered where clay deposits predominate, as in the eastern part of the map area and in the vicinity of Port Rowan. Low yields also

occur along river valleys. Yields can be enhanced in some of the these areas by constructing bored wells. Bored wells, because of their large diameters, usually can store sufficient amounts of water to meet short-term domestic requirements. However, difficulties may still be encountered in obtaining dependable, long-term supplies.

Yields of 2 to 10 gpm are available in most of the region from shallow sand deposits. These shallow sands are an important source of water supply for domestic and livestock purposes. Higher yields can be obtained from the sands for irrigation and other high water-demand purposes through the use of multiple sand-point systems. Where coarse sands and gravels are present, yields of 10 to 50 gpm have been reported. However, these coarse materials occur only locally within a broad area between Waterford and Courtland.

In deep overburden deposits (Map 2), yields of less than 2 gpm occur in the east and in the vicinity of Port Rowan where clay deposits predominate throughout the overburden sequence. Yields of 2 to 10 gpm are generally available; however, areas exhibiting yields of 10 to 50 gpm and greater than 50 gpm occur locally within a broad zone in the northern portions of the Regional Municipality.

In bedrock (Map 5), low yields of less than 2 gpm occur in the southwestern corner of the Regional Municipality. These low yields are due to the presence of shale bedrock which characteristically contains few water-bearing zones.

In most of the western half of the Regional Municipality, there has been little exploration for ground water in bedrock since adequate sources of water are found in the overburden. Bedrock in these areas consists of limestone and dolomite and is assumed to yield 2 to 10 gpm, although higher yields may be obtained.

In the northern and eastern half of the Regional Municipality, extensive areas of yields from 10 to 50 gpm and greater than 50 gpm are present in the bedrock.

Depths to Water-Bearing Zones

Depths to water-bearing zones maps (maps 3 and 6) indicate the depths at which wells can obtain the yields reported on maps 2 and 5.

Most of the water-bearing zones in the overburden (Map 3) are found within 50 feet of the surface. While deeper zones are present (50 to 100 and 100 to 150 feet), they are found less frequently and are not extensive.

Depths to water-bearing zones in bedrock (Map 6) generally increase from east to west, ranging from less than 50 feet to over 300 feet.

Water-bearing zones in bedrock commonly occur within the first 20 feet of bedrock. Deeper zones do exist but they are found less frequently and are more costly to reach.

Water Quality

Ground-water quality in the overburden is generally acceptable for domestic use, although much of the water is very hard. Ground water from bedrock, as well as from overburden close to bedrock, is often of poor quality. Sulphurous water is obtained frequently from both of the latter sources.

The inorganic chemical quality of ground water at any location in the Regional Municipality can be estimated by inspecting the analyses of nearby ground-water samples shown in tables 1, 2 and 3 on Sheet 4. The locations of samples are shown on maps 1, 2 and 5. The samples were taken from selected overburden and bedrock wells and indicate the quality of ground water in the common water-bearing zones in different parts of the study area.

Of the 48 samples taken, 15 were obtained from shallow overburden wells (Table 1), 18 samples from deep overburden wells (Table 2), and 15 samples from bedrock (Table 3).

The following table contains inorganic water quality criteria that are found in the Ontario Ministry of the Environment publication "Guidelines and Criteria for Water Quality Management in Ontario, 1974". These criteria are maximum concentrations that are recommended for public and private ground-water supplies and for livestock use. While the criteria generally should be adhered to, slight excesses usually are not harmful. In cases where the quality of the water supply is in doubt, local health authorities should be consulted.

WATER-QUALITY PARAMETERS

Substance	Significance	Permissible Criteria Public Supplies	Livestock Supplies
Iron	Iron in excessive concentrations will precipitate after exposure to air, which causes turbidity, stains plumbing fixtures, laundry and cooking utensils, and imparts objectionable tastes and colours to foods and drinks.	0.03 mg/l*	not set
Hardness (Calcium, Magnesium)	Consumes soap before a lather will form. Hard water forms scale in water heaters and pipes. Water of hardness greater than 180 mg/l is classified as very hard.	not set	not set

cont'd. ...

Substance	Significance	Permissible Criteria Public Supplies	Livestock Supplies
Sodium, Potassium	Large amounts in combination with chloride give a salty taste. Moderate quantities have little effect on the usefulness of water for most purposes. A high sodium content may limit the use of water for irrigation and in some instances for domestic consumptive uses.	not set	not set
Boron	The amount of boron found normally in drinking water is not generally regarded as hazardous to human health. Excessive amounts of boron can be injurious to crops.	1.0 mg/l	not set
Sulphate	In large amounts, sulphate can have laxative effects on unaccustomed users and in combination with other ions, gives a bitter taste to water.	250 mg/l	1000 mg/l
Chloride	In large amounts and in combination with sodium, chloride gives water a salty taste and increases the corrosiveness of water.	250 mg/l	not set
Fluoride	In large amounts, fluoride can disfigure teeth by mottling the enamel. However, in more desirable amounts (1.0 mg/l), fluoride has been found to inhibit tooth decay.	1.0 mg/l (artificial) 2.4 mg/l (natural)	2.4 mg/l
Nitrate	Concentration much greater than the natural regional background may suggest pollution. Waters of high nitrate content cause methemoglobinemia (an often fatal infant disease) and therefore, should not be used in infant feeding. Nitrate encourages the growth of algae and other organisms that produce undesirable tastes and odours.	10 mg/l	20 mg/l
Dissolved Solids	High dissolved solids may often suggest that criteria of one or more substances have been exceeded.	500 mg/l	2500 mg/l
pH	pH outside the limits may suggest pollution	6.00-8.5	not set

*mg/l = milligrams of substance per litre of water

Sulphurous Water in Bedrock Wells

Sulphurous water is recognized by its distasteful "rotten-egg" smell (hydrogen sulphide gas) and may contain high concentrations of sulphate which can have laxative effects on people unaccustomed to the water.

The occurrence of sulphurous water in the Regional Municipality is erratic. It can be assumed that if an area on Map 8 has no record of sulphurous wells, it is likely that a proposed well drilled into bedrock also will not obtain sulphurous water. One area relatively free of sulphurous water occurs in the vicinity of Boston and extends westward along the northern boundary of the study area. However, it is possible that some wells with sulphurous water may not have been recorded and therefore, there may be more sulphurous wells than those shown on the map.

The depths from the top of bedrock to the sulphurous water-bearing zones are generally variable and have no discernible trends in the area. However, in an effort to avoid sulphurous water, adequate supplies first should be sought from overburden. If this is not possible, ground water in bedrock should be sought at depths shallower than nearby wells reporting sulphurous waters.

APPENDIX

ASSESSING DOMESTIC AND LIVESTOCK WATER REQUIREMENTS

When constructing a water well, all present and anticipated water requirements should be estimated beforehand in order to determine the well yield necessary for an adequate supply of water. A well must be able to supply both the daily- and peak-period water requirements of the household. Otherwise, a larger water storage tank may have to be installed.

To estimate the approximate daily domestic and livestock requirements, multiply the number of users (people and animals) by the appropriate figure in the table below. If desired, an additional 20 to 30% can be added to the total to account for increased demand in the future. While individual residential needs are difficult to estimate, most homes with water-consuming items such as washing machines will average about 100 gallons per day per person.

It is important to take into account the water demand during peak periods of usage in order that the well does not run dry temporarily. This demand can be estimated by counting the number of fixtures and water outlets in the house which will be used at one time and multiplying it by the flow rate for each. Tables showing the flow rate per fixture can be obtained from water-supply equipment dealers.

Approximate Daily Water Requirements

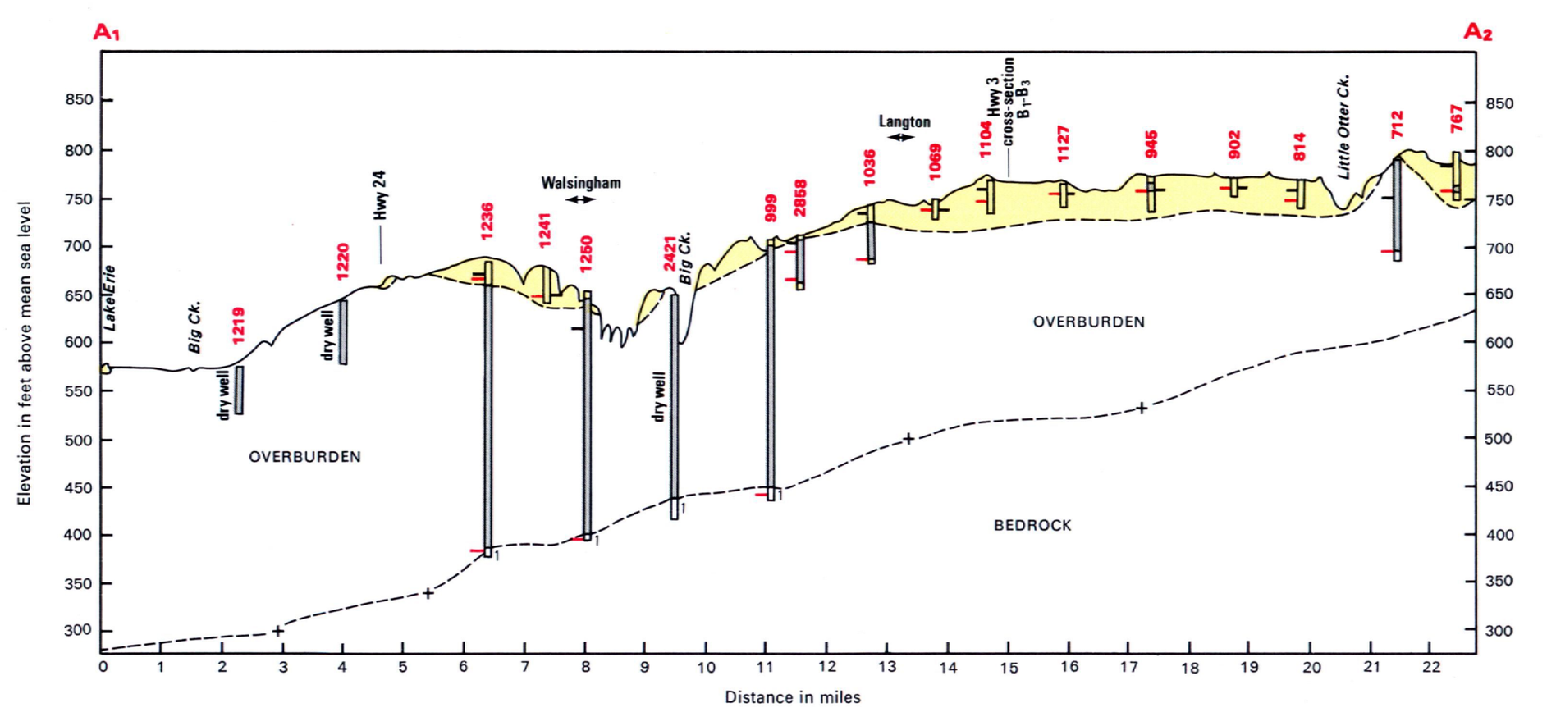
each member of the family (kitchen, laundry, bath)	50 to 150 gallons per day
each producing milk cow (including washing)	35 gallons per day
each dry cow	15 " " "
each steer, horse	12 " " "
each hog	4 " " "
each sheep	2 " " "
each 100 chickens	6 " " "
each 100 turkeys	12 " " "

-table modified from F. R. Hore, Farm Water Supply, Ontario Department of Agriculture and Food, Publication 476.

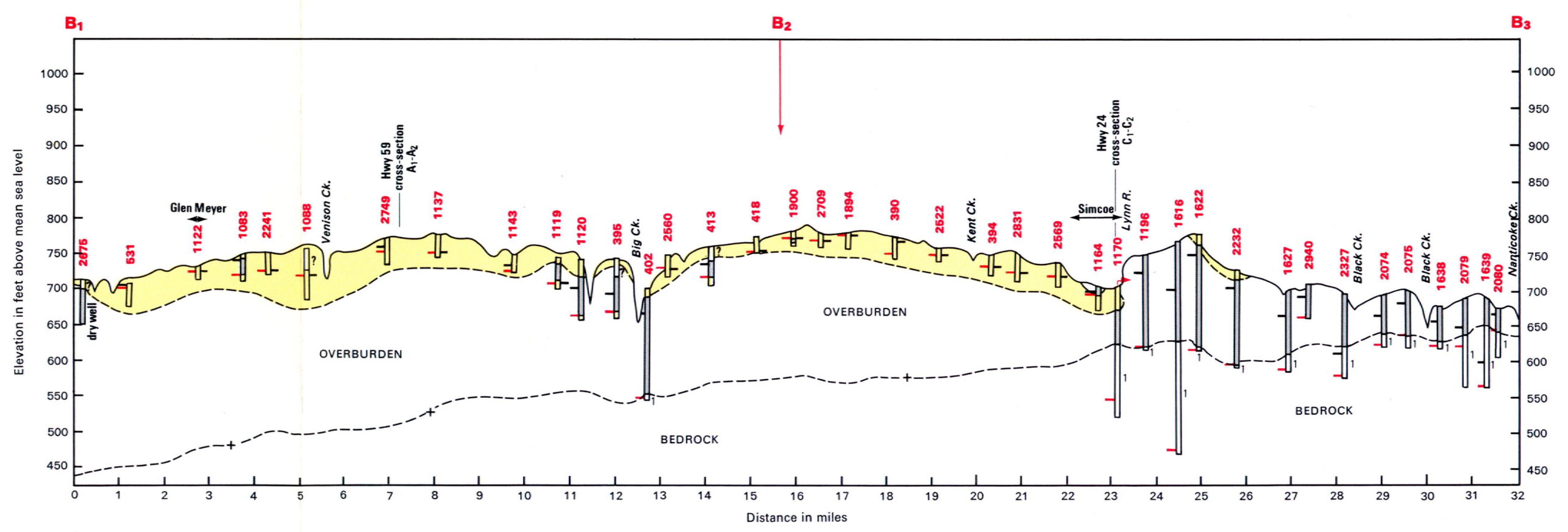
For information on irrigation requirements contact your regional office of the Ontario Ministry of Agriculture and Food.

A COMPARISON OF DIFFERENT WELL TYPES AND THEIR APPLICATIONS

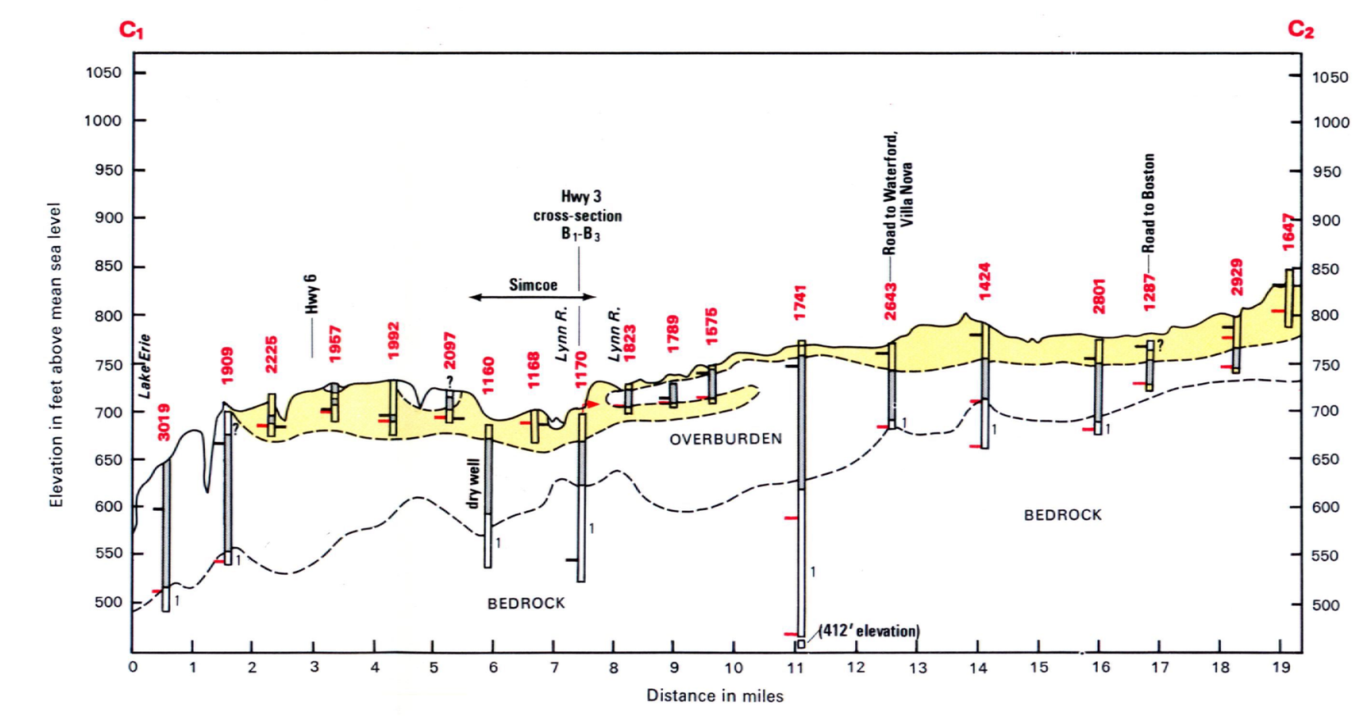
WELL TYPE	SUITABLE GEOLOGIC MATERIALS	ADVANTAGES	DISADVANTAGES
DUG WELLS	OVERBURDEN both low and high yielding materials (gravel, sand, silt, clay)	1. Does not require special machinery to construct 2. Large diameter provides reservoir storage to augment low yields	1. Labour intensive to construct 2. Depth is limited because of caving 3. Well failure is common during dry period because of usually shallow depths
BORED WELLS	OVERBURDEN both low and high yielding materials (gravel, sand, silt)	1. Efficient method of constructing large diameter wells 2. Large diameter provides reservoir storage to augment low yields	1. Depth is usually limited because of well drilling equipment limitations and very hard earth materials
DRILLED WELLS	OVERBURDEN AND BEDROCK moderate to high yielding materials (sand, gravel, sandstone, limestone)	1. Can reach deeper depths than other techniques 2. Can penetrate bedrock	1. Generally small diameter wells with little reservoir storage capacity
DRIVEN OR JETTED WELLS (Sand Points)	OVERBURDEN moderate to high yielding materials (sand and gravel)	1. Simple installation; can be done by hand or machine 2. A number of these wells can be hooked into one water-supply system	1. Small diameter provides little reservoir storage 2. Depth is limited; depends on materials in the overburden



CROSS SECTION $A_1 - A_2$



CROSS SECTION $B_1 - B_3$



CROSS SECTION $C_1 - C_2$

LEGEND FOR CROSS SECTIONS

- Overburden with high permeability and therefore good water-yielding capacity from saturated zones; primarily sands and/or gravels; this general classification does not infer a homogeneous geological unit but includes sands and gravels of different origins and physical characteristics; some fine sands with good water-yielding capacities are included in this classification
- Overburden with low permeability and therefore poor water-yielding capacity; clay, silt, very fine sand, clay and stones
- 1 — Limestone
- Water well
- Location of static water level
- Location of top of water-bearing zone
- Flowing well
- ? — Previously constructed well; material unknown
- + — Bedrock surface data obtained from oil-and gas-well records
- 1823 — Water well number

Horizontal scale 1:200,000
Vertical scale 1 inch=200 feet

NOTE

Wells shown above or below ground level have been projected onto the line of cross section

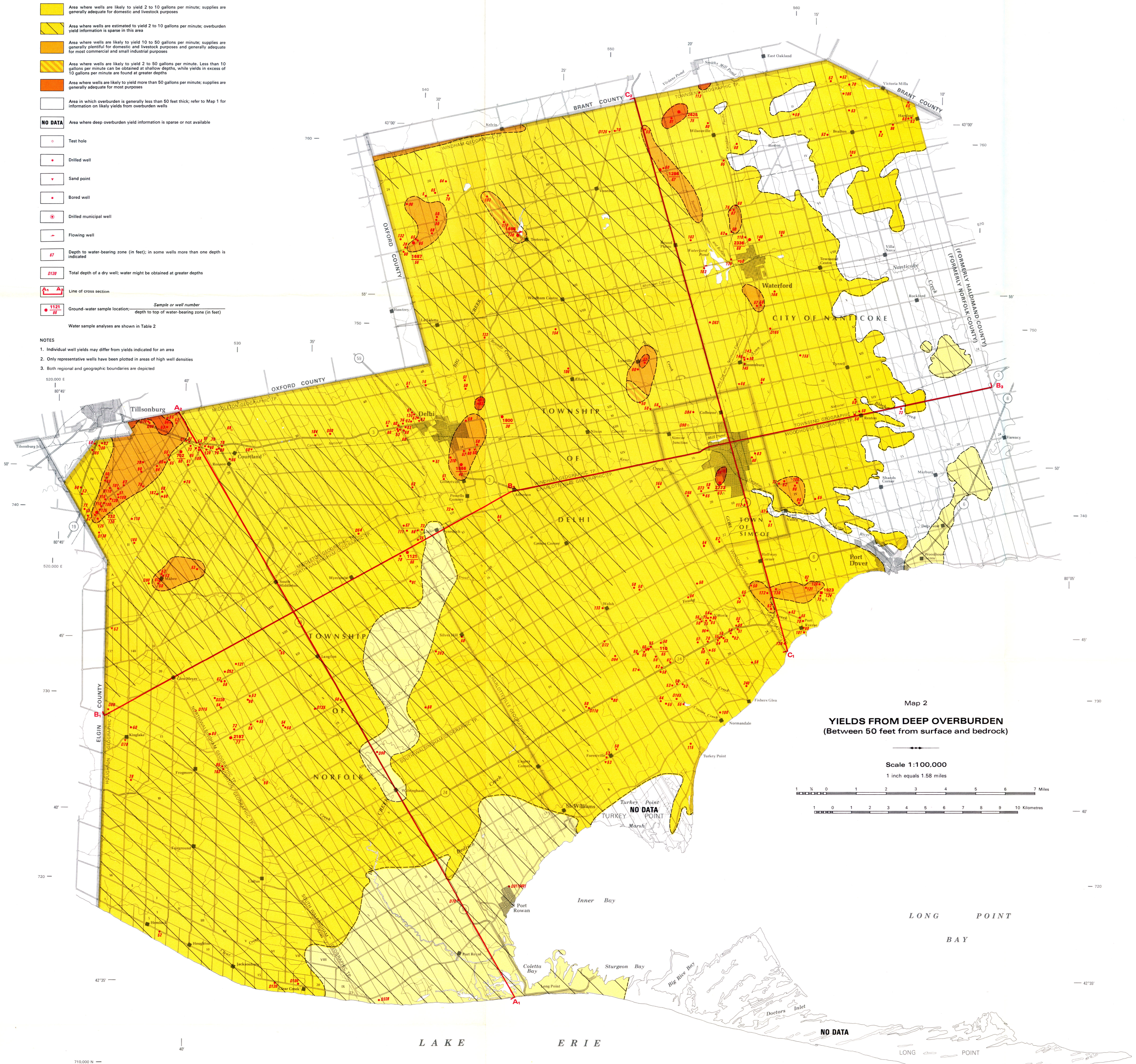
LEGEND

- Area where wells are estimated to yield less than 2 gallons per minute; difficulties are encountered in obtaining sufficient quantities of water for any purpose; overburden yield information is generally sparse in this area
- Area where wells are likely to yield 2 to 10 gallons per minute; supplies are generally adequate for domestic and livestock purposes
- Area where wells are estimated to yield 2 to 10 gallons per minute; overburden yield information is sparse in this area
- Area where wells are likely to yield 10 to 50 gallons per minute; supplies are generally plentiful for domestic and livestock purposes and generally adequate for most commercial and small industrial purposes
- Area where wells are likely to yield 2 to 50 gallons per minute. Less than 10 gallons per minute can be obtained at shallow depths, while yields in excess of 10 gallons per minute are found at greater depths
- Area where wells are likely to yield more than 50 gallons per minute; supplies are generally adequate for most purposes
- Area in which overburden is generally less than 50 feet thick; refer to Map 1 for information on likely yields from overburden wells
- NO DATA — Area where deep overburden yield information is sparse or not available
- Test hole
- Drilled well
- Sand point
- Bored well
- Drilled municipal well
- Flowing well
- 67 — Depth to water-bearing zone (in feet); in some wells more than one depth is indicated
- D120 — Total depth of a dry well; water might be obtained at greater depths
- A_1 A_2 — Line of cross section
- 1121/66 — Ground-water sample location; Sample or well number / depth to top of water-bearing zone (in feet)

Water sample analyses are shown in Table 2

NOTES

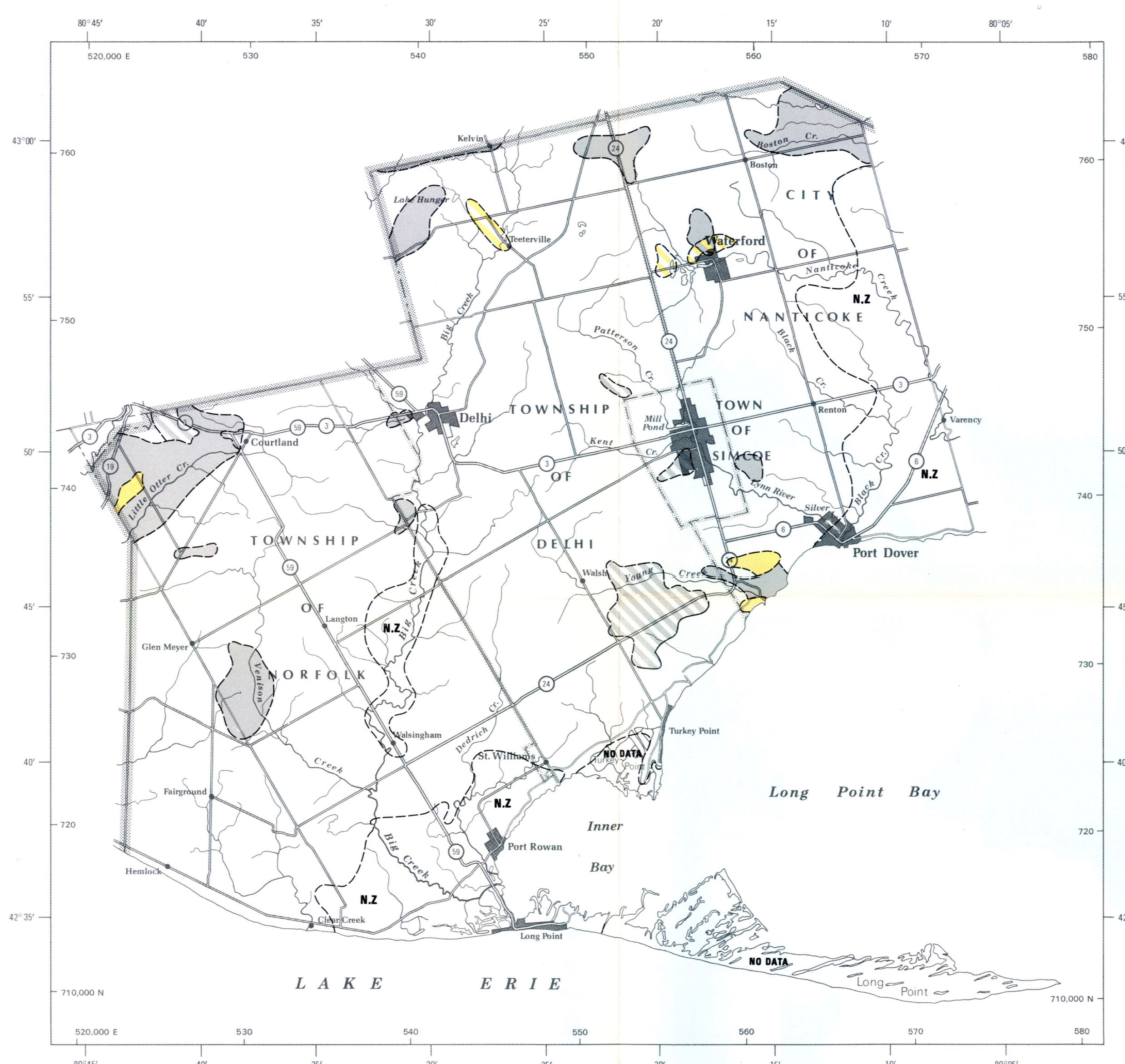
1. Individual well yields may differ from yields indicated for an area
2. Only representative wells have been plotted in areas of high well densities
3. Both regional and geographic boundaries are depicted



Map 2

YIELDS FROM DEEP OVERBURDEN
(Between 50 feet from surface and bedrock)

Scale 1:100,000
1 inch equals 1.58 miles



Map 3

DEPTHS TO WATER-BEARING ZONES IN DEEP OVERBURDEN
(Between 50 feet from surface and bedrock)

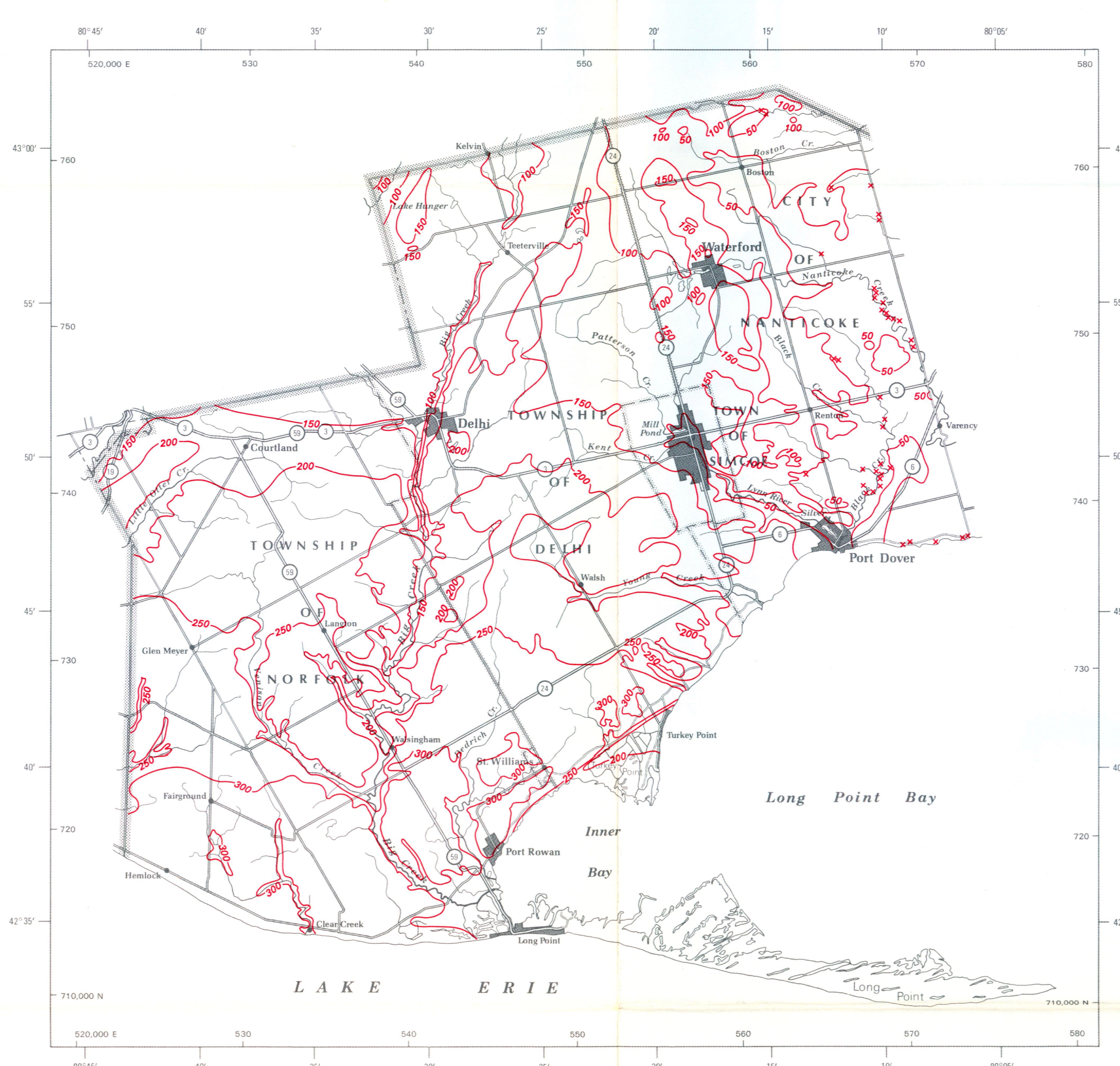
Scale 1:250,000
1 inch equals approximately 4 miles

LEGEND

- Area in which most overburden wells obtain water within 50 feet of ground surface
- Area in which most overburden wells obtain water between 51-100 feet below ground surface
- Area in which most overburden wells obtain water within 50 feet below ground surface and between 51-100 feet below ground surface
- Area in which most overburden wells obtain water between 101-150 feet below ground surface
- Area in which most overburden wells obtain water within 50 feet below ground surface and between 101-150 feet below ground surface
- Area in which most overburden wells obtain water between 51-100 feet and between 101-150 feet below ground surface
- N.Z — Area in which there are no significant water-bearing zones; for the purposes of this map, water-bearing zones are defined as those zones yielding more than 2 gallons per minute
- NO DATA — Area in which depth to water-bearing zones information is not available

NOTE

Base data for this map is indicated on Map 2



Map 4

OVERBURDEN THICKNESS

Scale 1:250,000
1 inch equals approximately 4 miles

LEGEND

- Line of equal overburden thickness, 50-foot interval
- Bedrock outcrop

SOURCES OF INFORMATION

Map compilation and interpretation by A. Hickinbotham, 1977.

Cartography by H. De Souza, B. Fischer and T. Gammage.

Barnett, P.J., Girard C.K., and Watt, A.K., 1975, Quaternary geology of the Simcoe area, southern Ontario; Ont. Div. Mines, Prelim. Map P. 1054, Geol. Ser.

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Cowan, W.R., 1972, Pleistocene geology of the Brantford area; Ont. Dept. Mines and Northern Affairs, Map 2240.

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Sibul, U., 1969, Water resources of the Big Otter Creek drainage basin; Ont. Water Resour. Comm., Div. Water Resour., Water Resour. Rept. 1.

Yakutchik, T.J., and Lammers, W., 1970, Water resources of the Big Creek drainage basin; Ont. Water Resour. Comm., Div. Water Resour., Water Resour. Rept. 2.

Geologic information was derived from water-well records on file with the Ontario Ministry of the Environment up to July 1974, and from oil- and gas-well records on file with the Ontario Ministry of Natural Resources up to July 1974.

Base map was derived from 1:25,000 and 1:50,000 sheets of the National Topographic Series and from the Ontario Ministry of Transportation and Communications.

Ontario
MINISTRY OF THE ENVIRONMENT
Water Resources Branch

REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK (Western Portion)

MAP 3124

GROUND WATER PROBABILITY

SHEET 2

WATER SUPPLIES IN DEEP OVERBURDEN
(BETWEEN 50 FEET FROM SURFACE AND BEDROCK)

Published 1978

Map 5

YIELDS FROM BEDROCK

Scale 1:100,000

1 inch equals 1.58 miles

1 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 10 Kilometres

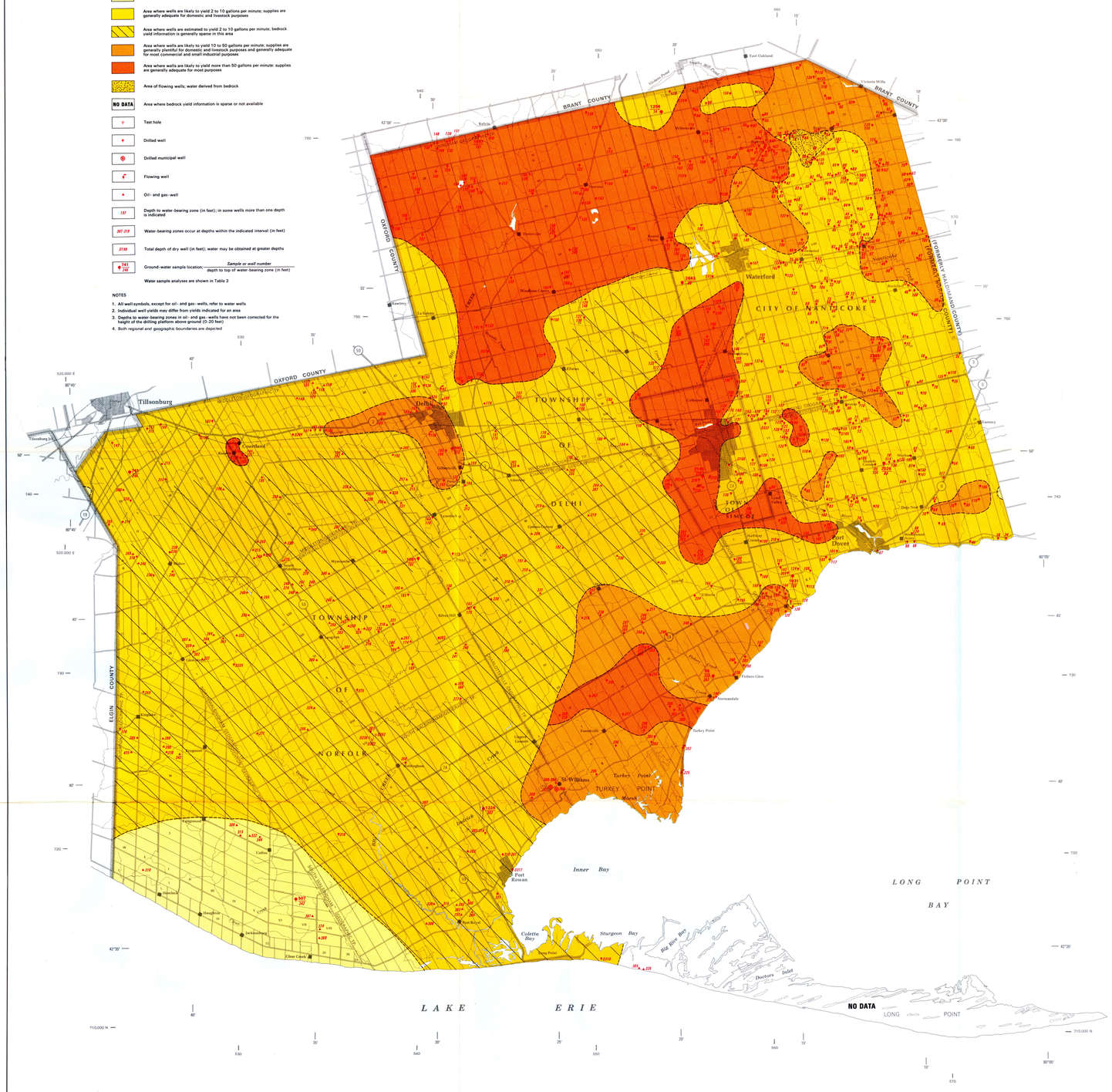
LEGEND

- Area where wells are likely to yield less than 2 gallons per minute; difficulties are encountered in obtaining sufficient quantities of water for any purpose
- Area where wells are likely to yield 2 to 10 gallons per minute; supplies are generally adequate for domestic and livestock purposes
- Area where wells are estimated to yield 2 to 10 gallons per minute; bedrock yield information is generally sparse in this area
- Area where wells are likely to yield 10 to 50 gallons per minute; supplies are generally plentiful for domestic and livestock purposes and generally adequate for most commercial and small industrial purposes
- Area where wells are likely to yield more than 50 gallons per minute; supplies are generally adequate for most purposes
- Area of flowing wells; water derived from bedrock
- NO DATA — Area where bedrock yield information is sparse or not available
- Test hole
- Drilled well
- Drilled municipal well
- Flowing well
- Oil- and gas-well
- 137 — Depth to water-bearing zone (in feet); in some wells more than one depth is indicated
- 307-315 — Water-bearing zones occur at depths within the indicated interval (in feet)
- 518f — Total depth of dry well (in feet); water may be obtained at greater depths
- 243 / 210 — Ground-water sample location; Sample or well number / depth to top of water-bearing zone (in feet)

Water sample analyses are shown in Table 3

NOTES

1. All well symbols, except for oil- and gas-wells, refer to water wells
2. Individual well yields may differ from yields indicated for an area
3. Depths to water-bearing zones in oil- and gas-wells have not been corrected for the height of the drilling platform above ground (0-20 feet)
4. Both regional and geographic boundaries are depicted



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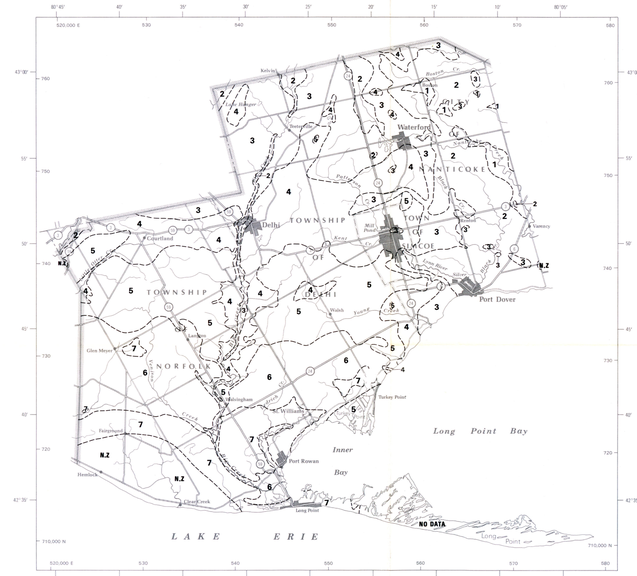

Map 6

DEPTHS TO WATER-BEARING ZONES IN BEDROCK

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

LEGEND

- 1 — Area in which most bedrock wells obtain water within 50 feet of ground surface
- 2 — Area in which most bedrock wells obtain water between 51-100 feet below ground surface
- 3 — Area in which most bedrock wells obtain water between 101-150 feet below ground surface
- 4 — Area in which most bedrock wells obtain water between 151-200 feet below ground surface
- 5 — Area in which most bedrock wells obtain water between 201-250 feet below ground surface
- 6 — Area in which most bedrock wells obtain water between 251-300 feet below ground surface
- 7 — Area in which most bedrock wells obtain water between 301-350 feet below ground surface
- N.Z — Area in which there are no significant water-bearing zones ; the lack of significant zones in this area is due to low-yielding shale bedrock ; at greater depths, where sandstone is usually encountered in the underlying limestone; for the purposes of this map, water-bearing zones are defined as those zones yielding more than 2 gallons per minute
- NO DATA — Area in which depth to water-bearing zone information is not available

NOTE

Base data for this map is indicated on Map 5

2149

Map 7

BEDROCK GEOLOGY AND TOPOGRAPHY

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

LEGEND

PALAEOZOIC

MIDDLE DEVONIAN

- 6 — MARCELLUS FORMATION: shale and minor limestone
- 5 — DUNDEE FORMATION: limestone
- 4 — DETROIT RIVER GROUP: limestone and dolomite

LOWER DEVONIAN

- 3 — BOIS BLANC FORMATION: dolomite and limestone

UPPER SILURIAN

- 2 — BASS ISLAND FORMATION: dolomite
- 1 — SALINA FORMATION: dolomite, shale and gypsum
- 600 — Bedrock surface elevation contour, interval 25 feet (all elevations in feet above mean sea level)

NOTES

1. Bedrock geology after Sanford (1969)
2. Bedrock surface elevation data obtained from oil- and gas-wells have not been corrected for the height of the drilling platform above ground surface (0-20 feet)

2150

SOURCES OF INFORMATION

Map compilation and interpretation by A. Hickinbotham, 1977.

Cartography by H. De Souza, B. Fischer and T. Gammage.

Hewitt, D.F., and Liberty, B.A., 1972. Paleozoic geology of southern Ontario; Ont. Min. Res., Map 2254.

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Geologic information was derived from water well records on file with the Ontario Ministry of the Environment up to July 1974, and from oil- and gas-well records on file with the Ontario Ministry of Natural Resources up to July 1974.

Base map was derived from 1:25,000 and 1:50,000 sheets of the National Topographic Series and from the Ontario Ministry of Transportation and Communications.

Ontario

MINISTRY OF THE ENVIRONMENT

Water Resources Branch

REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK (Western Portion)

MAP 3124

GROUND WATER PROBABILITY

SHEET 3

WATER SUPPLIES IN BEDROCK

Published 1978

INORGANIC CHEMICAL ANALYSES OF GROUND-WATER SAMPLES

Table 1. Inorganic Chemical Analyses – Shallow Overburden Wells
(sample locations shown on Map 1)

Sample Number	Sampling Date	pH in Lab	Constituents in milligrams per litre (mg/l)											Total Alkalinity (mg/l $CaCO_3$)	Total Hardness (mg/l $CaCO_3$)	Total Dissolved Solids (mg/l)	Specific Conductance in Lab (μmhos/cm^3 at 25°C)
			Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Boron (B)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (N)				
93	19/5/76	7.8	0.90	50	6	3.0	0.3	<0.05	161	15	3	0.2	<0.1	132	152	182	280
367	19/5/76	7.5	<0.05	114	14	66.0	2.9	<0.05	288	59	105	0.1	7.1	236	340	546	900
474	19/5/76	7.7	<0.05	96	17	17.0	7.6	0.14	246	110	13	0.1	2.9	202	308	406	620
555	15/7/65	7.8	2.4	54	9	3.2	0.9	–	171	25	7	–	0.0	–	174	264	280
770	15/7/65	7.9	0.11	75	12	3.7	0.95	–	160	58	16	–	0.0	–	240	346	400
777	15/7/65	8.0	0.31	98	17	18.1	24.0	–	217	93	26	–	1.87	–	316	558	610
868	19/5/76	7.6	<0.05	106	17	7.0	5.5	<0.05	238	89	18	0.1	9.0	195	332	390	620
950	15/7/65	7.5	2.9	82	12	24.0	1.9	–	232	43	26	–	0.0	–	254	394	500
1061	31/7/64	8.1	0.09	56	9	3.2	–	–	161	39	6	–	0.8	132	178	–	280
1124	31/7/64	7.9	0.10	54	11	2.7	–	–	166	45	5	–	0.5	136	180	–	280
1897	27/7/64	7.9	0.10	66	11	3.7	–	–	146	62	9	–	4.0	120	212	–	340
2806	19/5/76	7.6	0.10	80	21	28.0	4.6	0.09	314	49	7	0.6	5.6	257	288	394	610
2884	19/5/76	7.9	0.20	74	42	20.0	2.3	0.28	160	270	3	1.6	0.1	131	356	506	690
99991	19/5/76	7.6	0.15	102	16	14.0	1.1	0.05	268	50	22	0.1	10.1	220	320	380	620
99994	19/5/76	7.2	0.35	57	6	7.0	7.7	<0.05	154	20	10	0.1	7.0	126	166	234	360

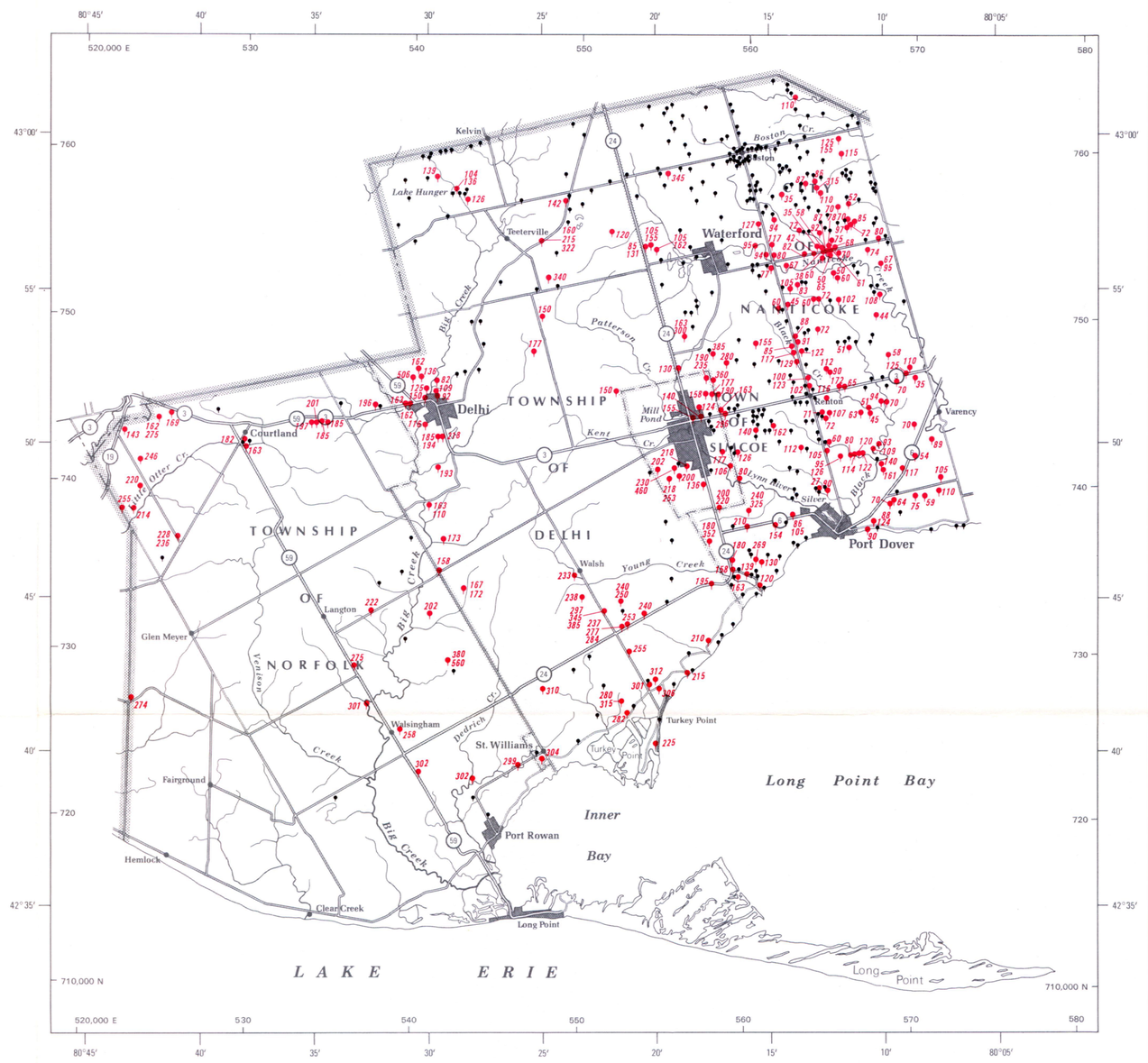
Table 2. Inorganic Chemical Analyses – Deep Overburden Wells
(sample locations shown on Map 2)

Sample Number	Sampling Date	pH in Lab	Constituents in milligrams per litre (mg/l)											Total Alkalinity (mg/l $CaCO_3$)	Total Hardness (mg/l $CaCO_3$)	Total Dissolved Solids (mg/l)	Specific Conductance in Lab (μmhos/cm^3 at 25°C)
			Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Boron (B)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (N)				
110	19/5/76	7.8	0.05	61	17	2.0	0.4	<0.05	189	29	12	0.1	6.0	155	220	273	420
223	30/7/64	7.7	0.16	84	17	8.0	–	–	232	107	8	–	0.8	190	280	–	460
702	29/7/65	8.0	0.30	10	6	35.0	1.3	–	124	0	3	–	0.00	–	50	182	210
732	19/5/76	7.8	0.55	57	14	7.0	0.9	<0.05	231	10	4	0.1	<0.1	189	198	237	365
946	31/7/64	8.0	0.29	54	11	2.9	–	–	137	71	6	–	trace	112	180	–	270
1121	30/7/64	8.0	5.80	38	11	16.0	–	–	203	9	4	–	0	166	142	–	260
1266	19/5/76	7.7	2.5	67	22	9.0	1.1	0.09	246	63	4	0.7	<0.1	202	258	293	490
1575	19/5/76	7.7	0.70	67	18	4.0	0.6	<0.05	243	34	4	0.2	0.1	199	240	283	435
1687	19/5/76	7.8	0.70	57	24	8.0	1.0	<0.05	276	18	4	0.8	0.1	226	240	289	445
1698	3/12/64	7.9	1.47	50	23	14.0	–	–	224	56	4	–	0	184	222	–	380
1800	27/7/64	7.8	0.69	61	15	4.4	–	–	227	32	5	–	2.5	186	214	–	340
1866	27/7/64	7.7	0.91	80	15	3.8	–	–	259	47	6	–	0	212	262	–	410
1923	19/5/76	7.9	0.10	35	21	40.0	1.4	0.22	198	3	70	1.6	<0.1	162	176	270	520
2073	19/5/76	7.9	<0.05	42	44	65.0	2.6	0.19	338	100	17	0.6	1.2	277	284	440	720
2197	19/5/76	8.0	0.45	46	8	4.0	0.3	<0.05	149	26	4	0.1	0.1	122	150	192	295
2336	19/5/76	7.7	0.05	72	20	110.0	1.1	<0.05	288	56	140	0.3	2.5	236	264	548	960
2625	19/5/76	7.8	<0.05	93	26	3.0	0.7	<0.05	306	48	14	0.1	9.8	251	338	283	450
2773	19/5/76	7.8	0.05	82	19	3.0	0.9	<0.05	226	78	11	0.1	3.2	185	286	324	530

Table 3. Inorganic Chemical Analyses—Bedrock Wells
(sample locations shown on Map 5)

Sample Number	Sampling Date	pH in Lab	Constituents in milligrams per litre (mg/l)											Total Alkalinity (mg/l $CaCO_3$)	Total Hardness (mg/l $CaCO_3$)	Total Dissolved Solids (mg/l)	Specific Conductance in Lab (μmhos/cm^3 at 25°C)
			Total Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Boron (B)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (N)				
55	19/5/76	7.9	0.95	48	20	110.0	5.8	0.96	266	25	133	2.2	0.7	218	204	524	870
507	19/5/76	7.2	0.05	104	18	8.0	3.8	0.05	288	85	11	0.1	1.2	236	336	386	630
584	30/6/65	8.1	0.61	61	22	28.5	1.7	–	266	20	12	–	0.0	–	242	362	460
741	30/6/65	8.4	0.10	6	8	67.5	1.5	–	140	4	25	–	0.0	–	50	258	300
940	19/5/76	7.6	0.05	107	20	120.0	15.0	<0.05	295	64	212	1.3	5.5	242	352	742	1230
1081	30/7/64	7.8	0.90	162	23	9.0	–	–	400	163	15	–	5.5	328	500	–	550
1224	19/5/76	7.3	0.05	110	31	9.0	2.2	0.08	409	56	7	0.3	<0.1	335	404	416	700
1254	19/5/76	7.7	0.25	52	27	7.0	1.3	0.06	261	24	4	1.1	0.1	214	240	293	450
1385	19/5/76	7.6	<0.05	114	63	48.0	1.9	0.05	433	130	44	0.1	21.0	355	544	762	1090
1657	17/7/64	7.9	1.0	35	25	19.0	–	–	266	7	1	–	trace	218	194	–	340
1931	19/5/76	7.7	6.6	50	21	54.0	2.7	0.36	266	2	68	1.9	<0.1	218	212	338	600
2026	19/5/76	7.6	0.15	38	45	48.0	2.8	0.32	372	60	6	1.8	0.1	305	292	396	650
2145	19/5/76	8.2	1.2	37	24	47.0	2.3	1.3	304	7	18	2.8	<0.1	249	190	356	510
2385	19/5/76	7.3	0.50	364	100	46.0	23.0	0.38	295	1100	60	1.0	<0.1	242	1320	1980	2075
2643	19/5/76	8.0	0.10	24	13	14.0	0.9	0.13	150	11	2	0.4	<0.1	123	112	166	255

NOTE: All except two sample numbers correspond to water-well numbers on file with the Ontario Ministry of the Environment; samples 99991 and 99994 (Table 1) were taken from wells not on file with the Ministry.



Map 8

SULPHUROUS WATER IN BEDROCK WELLS

Scale 1:250,000

1 inch equals approximately 4 miles

5 0 5 10 Miles

5 0 5 10 Kilometres

LEGEND

143 — Bedrock well with reported sulphurous water; depth to sulphurous water-bearing zone (in feet). In some wells, more than one depth is indicated

Bedrock well with no reported sulphurous water

Note:

"Sulphurous" water usually denotes the presence of hydrogen sulphide gas; a high concentration of sulphate (SO_4) may also be present

SOURCES OF INFORMATION

Map compilation by A. Hickinbotham.

Cartography by H. De Souza and B. Fischer.

Geologic information was derived from water-well records on file with the Ontario Ministry of the Environment up to July 1974, and from oil- and gas-well records on file with the Ontario Ministry of Natural Resources up to July 1974.

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Ontario

MINISTRY OF THE ENVIRONMENT
Water Resources Branch

REGIONAL MUNICIPALITY OF HALDIMAND-NORFOLK (Western Portion)

MAP 3124

GROUND-WATER PROBABILITY

SHEET 4

GROUND-WATER QUALITY

Published 1978

Map 1

YIELDS FROM SHALLOW OVERBURDEN
(Within 50 feet of surface)

Scale 1:100,000

1 inch equals 1.58 miles

1 ¼ 0 1 2 3 4 5 6 7 Miles

1 0 1 2 3 4 5 6 7 8 9 10 Kilometres

LEGEND

- Area where wells are likely to yield less than 2 gallons per minute; difficulties are encountered in obtaining sufficient quantities of water for any purpose. These yields are related to relatively impermeable surficial overburden and to drained surficial sands adjacent to major river valleys
- Area where wells are likely to yield 2 to 10 gallons per minute; supplies are generally adequate for domestic and livestock purposes. These yields are related to surficial water-bearing sands and gravels. Yields of 10 to 50 gallons per minute can be found locally between Waterford and Courtland, and near Windham Centre, Nixon and west of Simcoe
- Area where wells are likely to yield 10 to 50 gallons per minute; supplies are generally plentiful for domestic and livestock purposes and generally adequate for most commercial and small industrial purposes
- Area where wells are likely to yield more than 50 gallons per minute; supplies are generally adequate for most purposes
- Test hole
- Drilled well
- Sand point
- Bored well
- Drilled municipal well
- 24 — Depth to top of water-bearing zone (in feet)
- D44 — Total depth of a dry well; water might be obtained at greater depths
- 1897 / 27 — Ground-water sample location; Sample or well number / depth to top of water-bearing zones (in feet)

Water sample analyses are shown in Table 1

NOTES

1. Individual well yields may differ from yields indicated for an area
2. Multiple sand-point systems in most of the 2 to 10 gallons per minute areas can be used to obtain water sufficient for irrigation purposes
3. Only representative wells have been plotted in areas of high well densities
4. Both regional and geographic boundaries are depicted

SOURCES OF INFORMATION

Map compilation and interpretation by A. Hickinbotham, 1977.

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(Western Portion)

MAP 3124

GROUND WATER PROBABILITY

SHEET 1

WATER SUPPLIES IN SHALLOW OVERBURDEN
(WITHIN 50 FEET OF SURFACE)

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